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(52) UK CL (Edition S)

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(56) Documents Cited

EP 0889547 A2**EP 0239422 A****EP 0669627 A1****US 5397247 A****EP 0427615 A1****US 5316486 A**

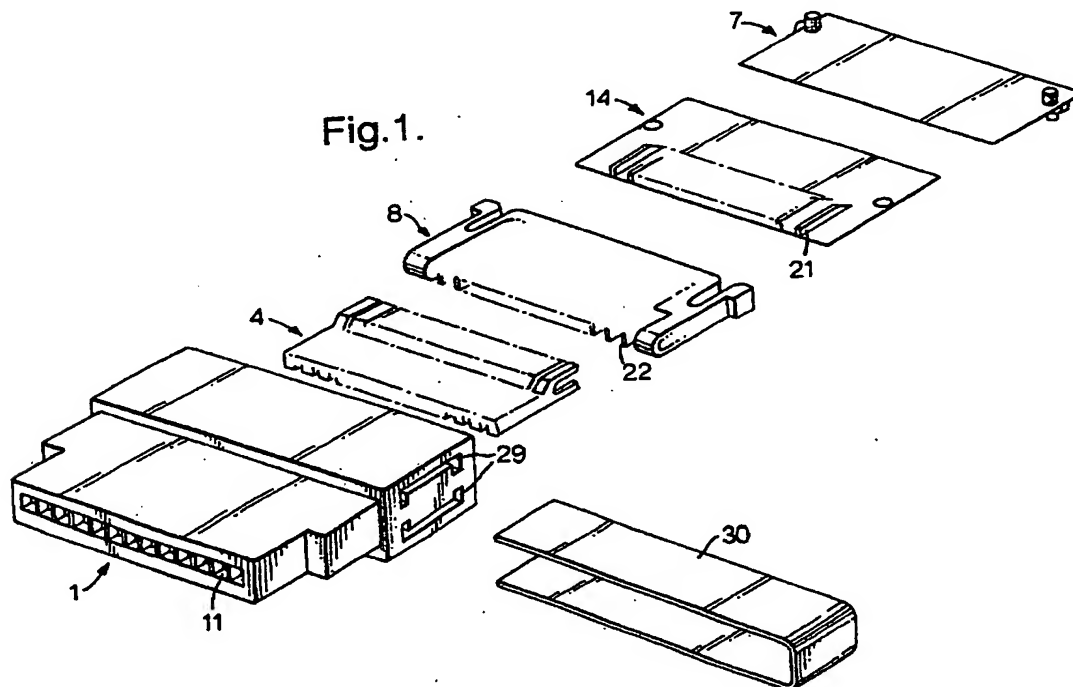
(58) Field of Search

UK CL (Edition R) H2E ECBX EDLX EHC**INT CL⁷ G01R , H01R , H05K**

(54) Abstract Title

Connector with flexible circuit contacts

(57) A connector for a flexible printed circuit or flexible flat cable having exposed conductors comprises a housing and a holder assembly. The housing includes a cavity having a plurality of terminals 29 installed therein for receiving the holder assembly. The holder assembly includes a holder 7 around which the flexible printed circuit 14 or flexible flat cable is folded and a holding cap 8 which is clipped onto the end of the holder whereby the flexible printed circuit or flexible flat cable is held between the holding cap and the holder. The holding assembly is inserted into the cavity and the terminals are in electrical contact with the exposed conductors of the flexible printed circuit or flexible flat cable. The cap has apertures 22 through which the terminals protrude.



The reference to figures 5, 6a & 6b of the drawings in the printed specification are to be treated as omitted under section 15(2) or (3) of the Patents Act 1977

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

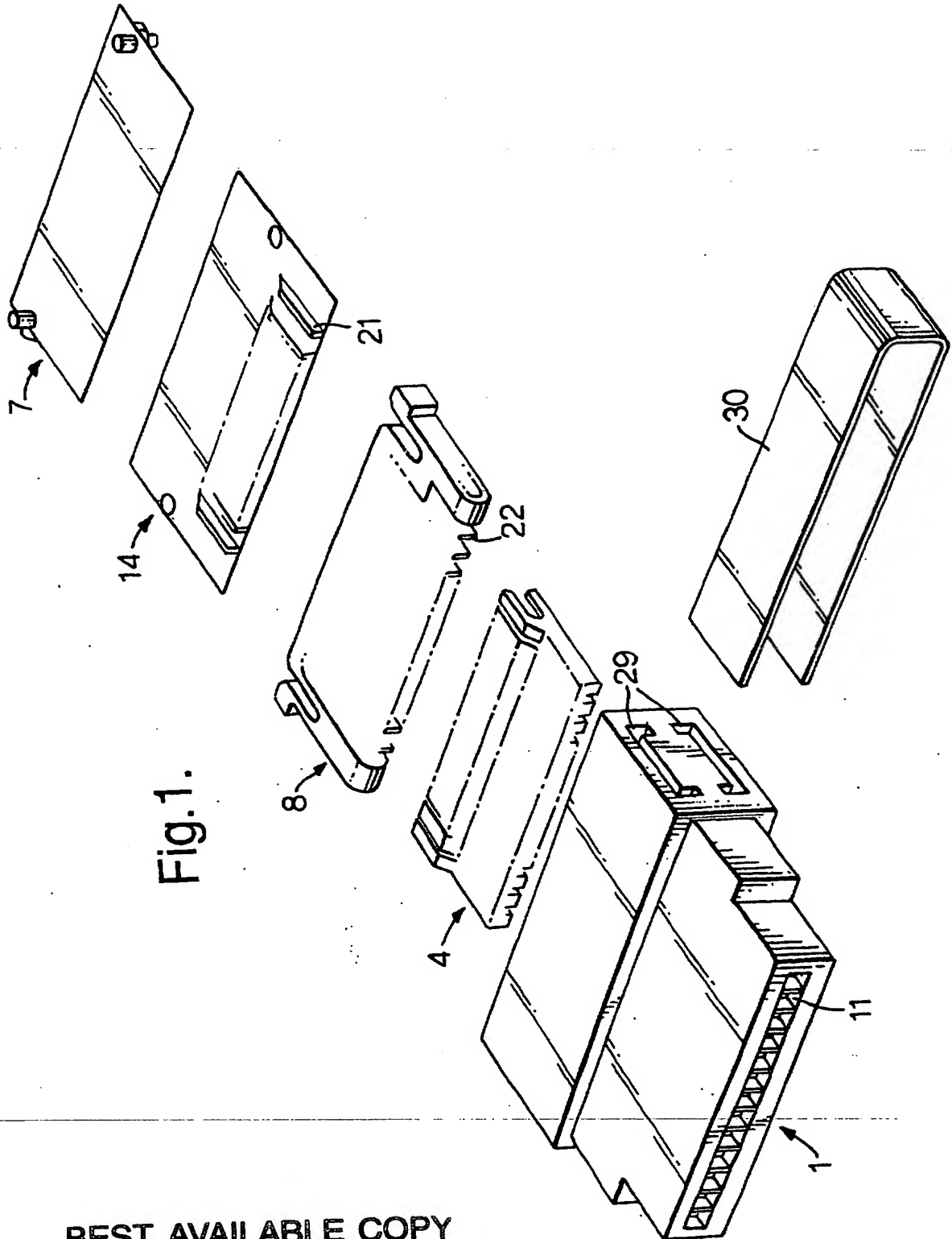


Fig.1.

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Fig.2.

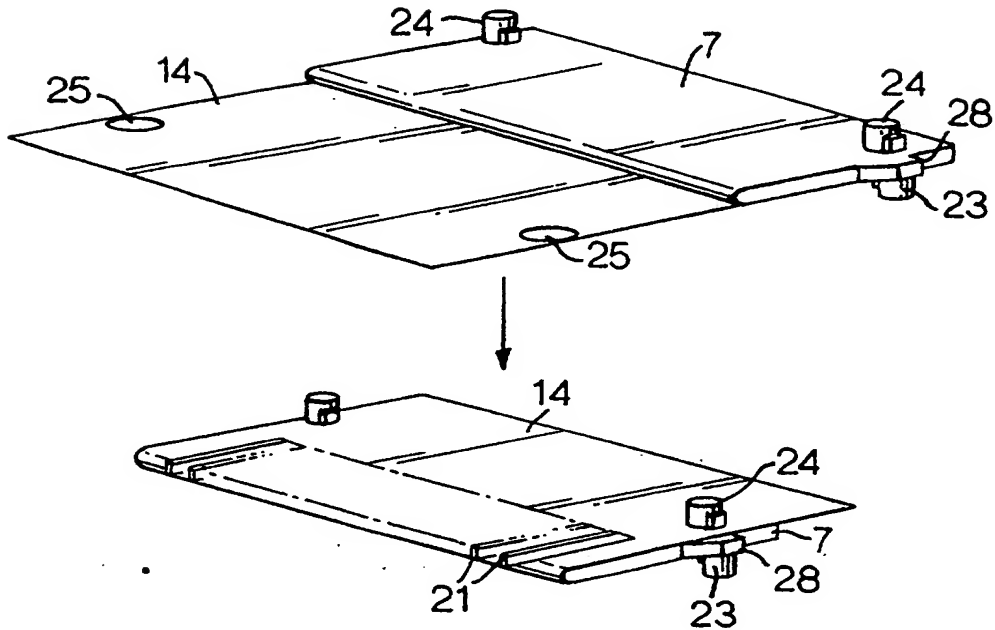


Fig.3.

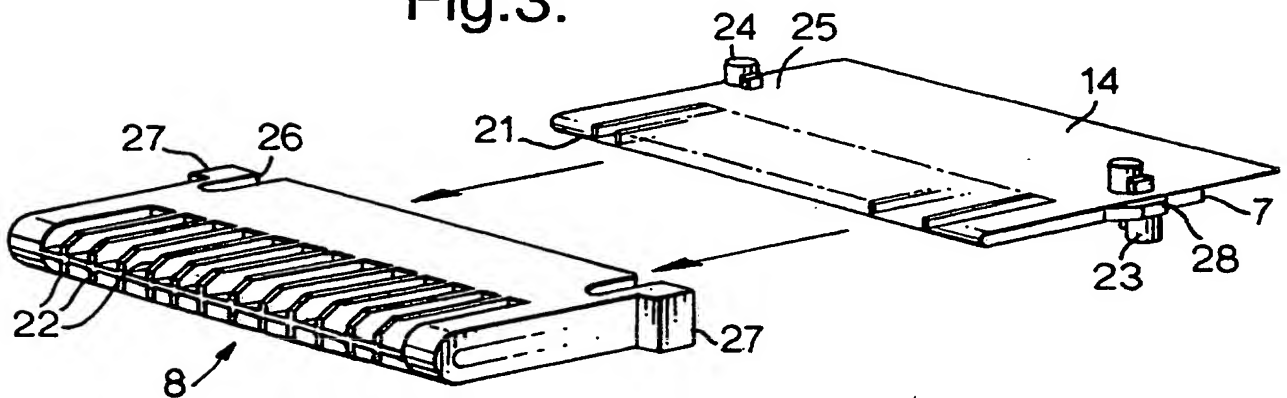


Fig.4A.

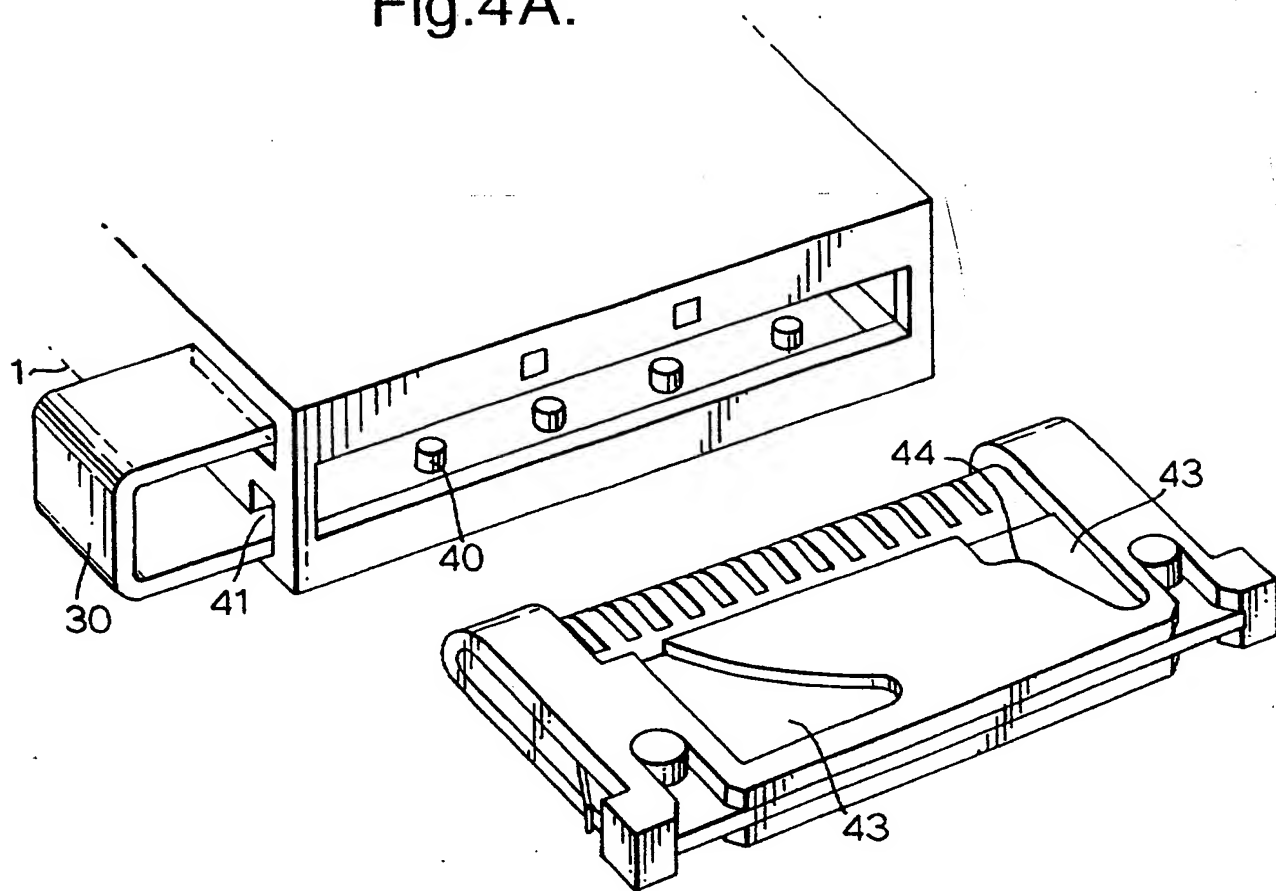


Fig.4B.

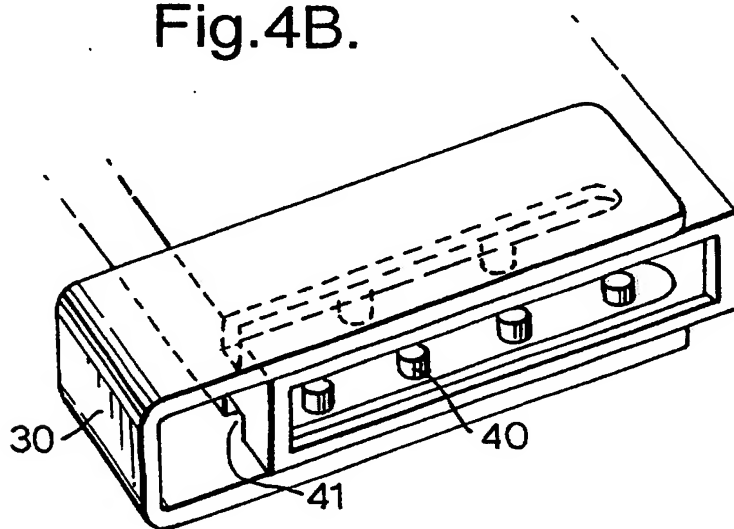


Fig.7.

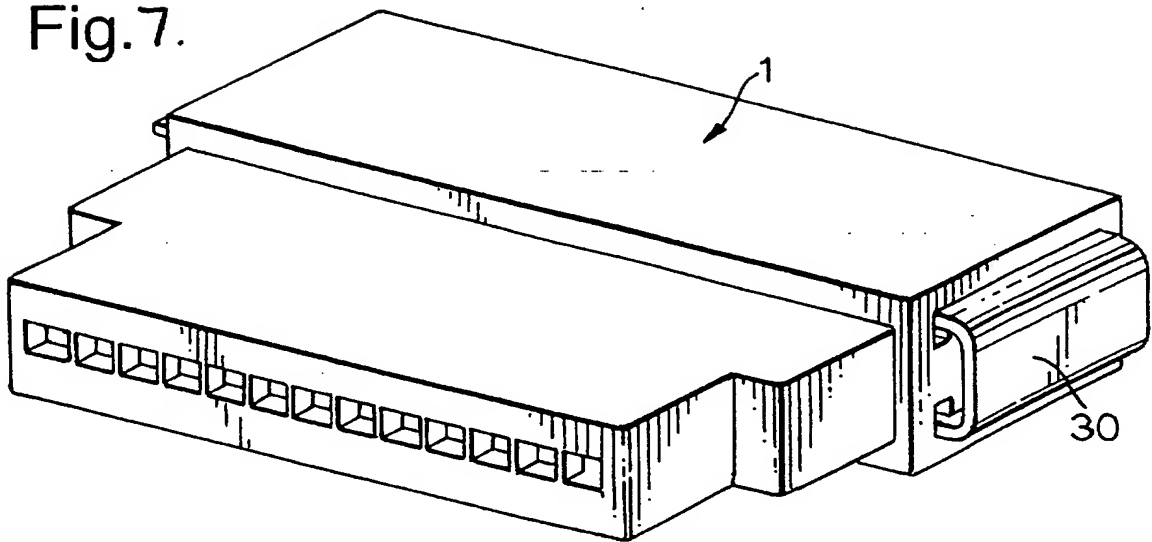
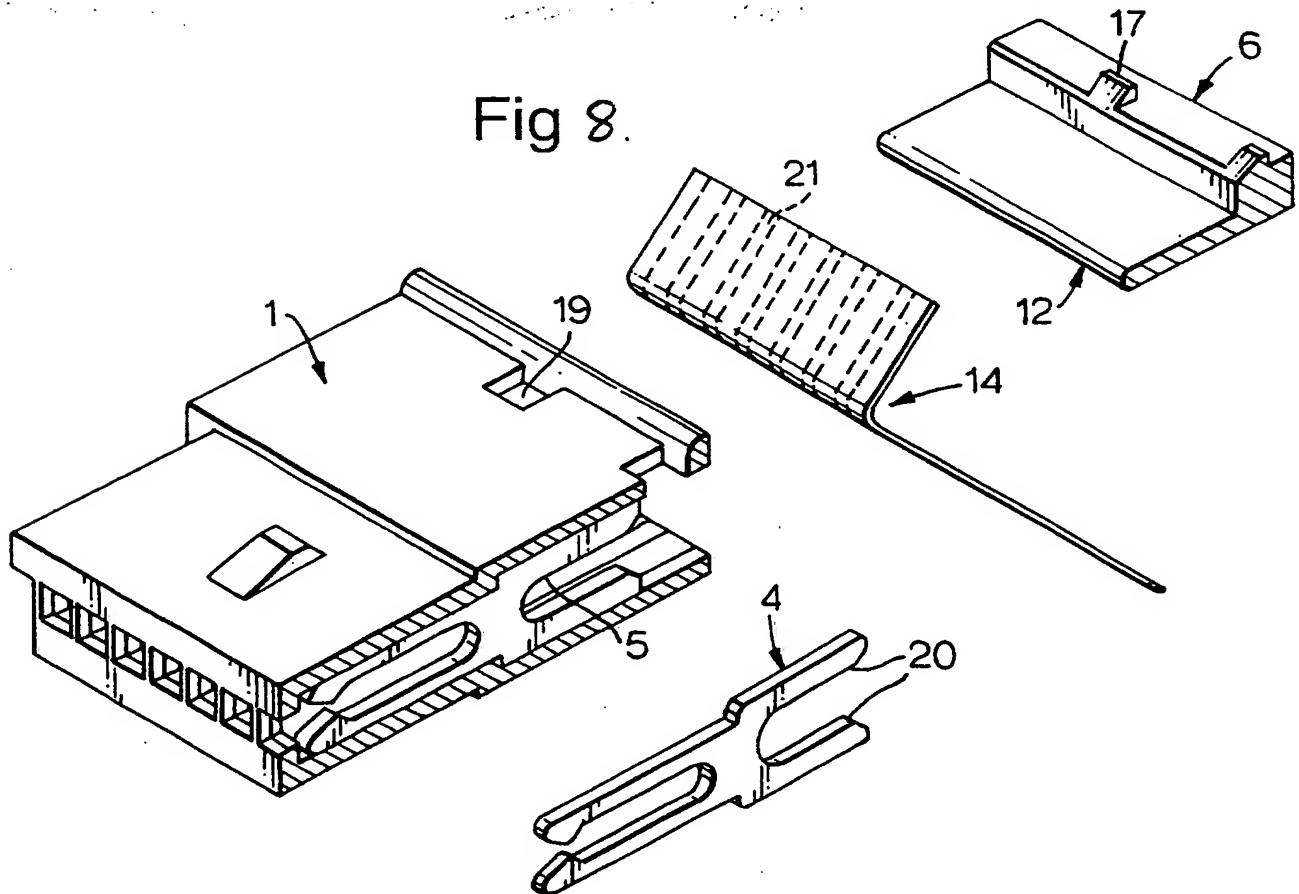


Fig 8.



ELECTRICAL CONNECTOR FOR A FLEXIBLE PRINTED CIRCUIT

Electrical connectors for flexible printed circuits (FPCs) or flexible flat cables (FFCs) generally comprise a housing having terminals mounted therein, and the flexible printed circuit is inserted into the housing so that the conductors of the flexible printed circuit make electrical connection with the terminals. Such a connector is described in EP-A-0239422 and is illustrated in Figure 6. In the connector of EP-A-0239422, the flexible flat cable is folded around an inserting and holding member having a wedging portion which is inserted into the housing between forked terminals which have sharp edges for cutting through insulation to contact the conductors of the flexible flat cable. The inserting and holding member has a locking projection which clips into a recess in the housing to lock the inserting and holding member in position. The locking projection is provided on the top of the connector.

In the connector of EP-A-0239422, the assembly position is unstable at insertion of the locking member. The flexible flat cable must be held in the correct alignment as the locking member is inserted. This makes assembly difficult, and the flexible flat cable may be inserted such that the conductors are not correctly aligned with the terminals. In addition, if the folded over portion of the flexible flat cable is too long, it will interfere with the engagement of the locking projection with the recess in the housing. Also, if the connector of EP-A-0239422 is used with flexible printed circuit in which the conductors are already exposed and are more delicate, the conductors may be damaged by the wedging action of inserting the holder into the housing.

According to the invention, a connector for a flexible printed circuit or flexible flat cable having exposed conductors comprises: a housing and a holder assembly, the housing including a cavity having a plurality of terminals installed therein for receiving the holder assembly, and

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the holder assembly including a holder around which the flexible printed circuit or flexible flat cable is folded and a holding cap which is clipped onto the end of the holder such that, in use, the flexible printed circuit or flexible flat cable is held between the holding cap and the holder and such that where the holding assembly is inserted into the cavity the terminals are in electrical contact with the exposed conductors of the flexible printed circuit or flexible flat cable.

10 The holding cap holds the FPC or FFC in position on the holder as the holding assembly is inserted into the cavity. This makes the connector easier to assemble as it holds the FPC or FFC in the correct position during insertion of the holding assembly. It also protects the exposed conductors from damage during insertion.

15 Preferably, the holding cap includes a plurality of openings, through which the terminals contact the exposed conductors of the flexible printed circuit or flexible flat cable. The terminals may include spring contacts which contact the exposed conductors of the FPC or FFC, but preferably the terminals are shaped and the holding assembly is inserted between the terminals. Preferably the holding cap includes openings on both sides so that the terminals contact the exposed conductors on both sides.

25 Preferably, the holding cap includes two side pieces which clip into engagement with two projections on the holder for holding the holding cap in position on the holder.

30 The side portions protrude above and below the plane of the holder and may be used to align the FPC or FFC on the holder before the holding cap is clipped onto the holder.

35 Alternatively, and more preferably, the connector further includes a sliding U shaped retainer having two substantially parallel arms which slide into two slots in one side of the housing to retain, in use, the holding

assembly and the flexible printed circuit or flexible flat cable in position.

5 Preferably the holder includes projections on each side, positioned to engage with holes in the edge of the flexible printed circuit. These projections hold and align the flexible printed circuit folded around the holder during insertion into the holding cap.

10 A preferred embodiment of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a side elevation of the components of a connector according to the present invention;

Figure 2 shows the assembly of the FPC onto the holder of a connector according to the present invention;

15 Figure 3 shows the assembly of the holder and the holding cap of a connector according to the present invention;

Figures 4A and 4B are perspective and plain views of a connector according to the invention;

20 Figure 5 is a cross-sectional view of a connector of the type shown in figure 6A with the holding mechanism partially inserted;

25 Figures 6A and 6B show a preset condition of alternative u-shaped retainers, the assembly of the holding assembly, the housing and the sliding retainer of a connector according to the present invention;

Figure 7 shows a fully assembled connector according to the present invention; and

Figure 8 shows a prior art connector.

30 In the prior art connector of Figure 8, a flexible flat cable 14 is folded around an inserting and holding member 6 having a wedging portion 12 which is inserted into a cavity 5 in a housing 1 between forked terminals 4 which have sharp edges 20 for cutting through insulation to
35 contact the conductors 21 of the flexible flat cable 14. The inserting and holding member 6 has a locking projection 17 which clips into a recess 19 in the housing 1 to lock

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the inserting and holding member 6 in position. The locking projection 17 is provided on the top of the connector.

In the embodiments of the present invention as shown in Figures 1 to 7, a housing 1 has a plurality of shaped terminals 4 located therein. An FPC 14 is folded around a holder 7, and the holder 7 is inserted into a holding cap 8 to form an FPC holding assembly which is inserted between the gripping springs of the terminals 4 inside the housing. Slots 22 in the holding cap 8 allow the terminals to contact the exposed conductors 21 of the FPC 14. A sliding U shaped retainer 30 having two substantially parallel arms slides into two slots 29 in the housing 1 to retain, the holder assembly 7, 8 and the FPC 14 in position. Openings 11 are provided in the housing for connection of the connector to a mating connector having pins which contact the terminals 4.

Figure 2 illustrates how the FPC 14 is connected to the holder 7. A first set of holes at the edges of the FPC 14 are aligned on locator tabs 23 on one side of the holder 7. The FPC 14 is then folded over the holder 7 and a second set of locator tabs 24 on the other side of the holder 7 engage in a second set of holes 25 at the edges of the FPC 14.

Figure 3 illustrates how the holding cap 8 is fitted over the holder 7 and the FPC 14. The holding cap comprises a U shaped parallel sided cover which fits over the holder 7 and FPC 14. Slots 26 are provided for accommodating the locator tabs 23, 24 for easy and correct position during insertion of the holder to the holding cap. Side pieces 27 of the holding cap 8 join the parallel sided and engage with two projections 28 on the sides of the holder 7. The projections 28 have ramped surfaces to allow the holding cap 8 to clip and lock into position over the holder 7 and the FPC 14. Slots 22 in the holding cap 8 expose the conductors 21 of the FPC and allow access for contact with the terminals 4 in the housing 1.

Figures 4A and 4B show a connector on which grooves 52 are formed on retainer 30 (figure 4B) the locator tabs 23,24 projecting over the holder 8 pass through slots in housing 1 and into the grooves 52 and retainer 30. At least one flat portion 53 is provided in at least one of the grooves 52 so that the holder 8 is positioned into a pre-set connecting position in the state of that the retainer 30 is positioned in the housing 1 by engaging a projection 62 to a hole 60 of the housing 1 prior to movement of the retainer 30, later movement of the retainer 30 to a position defined by engaging a projection 62 to a hole 61 drawing the holder 8 and FPC 14 into contact with electrical terminals 4. This ensures good electrical connection without a user having to place excessive force on the assembly.

Figure 5 shows the holder 8 in a pre-set position within the housing prior to closing movement of the retainer 30. As can be seen from this figure, the electrical terminal 4 is provided with a tongue 66 to lock it in the housing, the electrical terminal 4 is formed from a single plate of metal and is arranged in a gripping spring arrangement including an upper spring 63 and lower spring 64 and a slit 65 on side walls guiding holder 7 so that it provides good electrical contact with individual portions of the FPC 14 when the holding member 8 is fully engaged within the housing 1.

Figure 7 shows the fully assembled connector.

As shown in Figure 6A, the holder assembly is then pushed into the back of the housing 1. A retainer 30 is pushed into its receiving slots 29 and retains the holding assembly 7, 8 and the FPC 14 in position, holding the terminals 4 in contact with the exposed conductors 21 of the FPC 14.

As can be seen from figure 6A, the retainer 30 has a series of projections 40 on both its upper and lower inner surfaces. The projections 40 are positioned on the retainer 30 such that the retainer 30 can be inserted into

the housing 1 by passage of the projections 40 through notches 41. In this example the holder assembly has grooves 43 formed on the surface thereof and positioned such that, when the holder assembly is inserted into the housing 1, the grooves 43 engage with corresponding projections 40 and the holder assembly is held at a pre-set position by the flat portion 44 of groove 43. The grooves 43 are shaped such that further insertion of the retainer 30 urges the holder assembly into engagement with the terminals 4 in the housing 1. This ensures good electrical connection without a user having to place excessive force on the assembly. By careful selection of groove shapes it is possible also to provide withdrawal force by sliding the retainer 30 in the opposite direction. In this example the projections 41 have been shown on the retainer 30 and the corresponding grooves 43 on the holder assembly.

However a configuration with groove on the holder assembly and projections on the retainer 30 is possible.

Fig. 6B shows a connector similar to that of figure 6A, but in which the retainer 30 is positioned outside of the housing 1, with retaining members 40 passing through grooves 41 in the housing 1 to provide a movement and locking function of the type described above.

CLAIMS

1. A connector for a flexible printed circuit or flexible flat cable having exposed conductors comprising: a housing and a holder assembly, the housing including a cavity having a plurality of terminals installed therein for receiving the holder assembly, and the holder assembly including a holder around which the flexible printed circuit or flexible flat cable is folded and a holding cap which is clipped onto the end of the holder such that, in use, the flexible printed circuit or flexible flat cable is held between the holding cap and the holder and such that where the holding assembly is inserted into the cavity the terminals are in electrical contact with the exposed conductors of the flexible printed circuit or flexible flat cable.
2. A connector according to claim 1, wherein the holding cap includes a plurality of, through which the terminals contact the exposed conductors of the flexible printed circuit or flexible flat cable.
3. A connector according to claim 1 or 2, wherein the terminals are gripping spring shaped and the holding assembly is inserted between the gripping springs of the terminals.
4. A connector according to the preceding claims, wherein the holding cap includes two side pieces which clip into engagement with two projections on the holder for holding the holding cap in position on the holder.
5. A connector according to any of the preceding claims, wherein the holding cap includes slots which accommodate, in use, the locator tabs on the holder.

6. A connector according to any of the preceding claims, wherein the housing comprises a u-shaped retainer which engages, in use, with the holding assembly to retain it within the housing.

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7. A connector according to claim 6, wherein the retainer has projections or grooves formed on at least one inner surface thereof for engaging, in use, with groove or projections on the holding assembly.

10

8. A connector according to claim 7, wherein the projections and grooves are shaped such that sliding movement of the retainer with respect to the housing and holding assembly causes engagement of the projections and grooves and urges the holding assembly toward an engaging position within the housing.

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9. A connector according to claim 7 or claim 8, in which the projections or grooves are formed such that they prevent total insertion of the holding assembly until the retainer is moved from an open position to a closed position.

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INVESTOR IN PEOPLE

Application No: GB 0006284.4
Claims searched: 1 to 9

Examiner: Mr F J Fee
Date of search: 9 August 2000

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H2E [ECBX, EDLX, EHC]

Int Cl (Ed.7): G06K, H01R, H05K

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	EP 0889547 A2	[MOLEX] socket has spring contacts 31, 32 in cavity for receiving flexible circuit connector	1, 3, 6, 7
Y	EP 0669627 A2	[CANON] socket connector, figures 1, 6	1, 3
Y	EP 0427615 A1	[LABINAL] socket connector with spring terminals 57, figure 2	1, 3
Y	EP 0239422 A	[MOLEX] socket connector	1
Y	US 5316486	[TANAKA] plug has flexible circuit supported by holder 60 and held by cap 53	1
Y	US 5397247	[AOKI] socket connector 20 has single cavity for terminals 10 and receives holder	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.